SCIENCE.

FRIDAY, JULY 30, 1886.

COMMENT AND CRITICISM.

THE ANNUAL REPORT for 1885, of Prof. J. P. Lesley, state geologist of Pennsylvania, contains a review of the conditions of the survey since its re-establishment in 1874 that does not show a highly enlightened policy on the part of the Pennsylvania legislature. The total appropriations for the thirteen years from 1874 to 1886 were $545,000, averaging $42,000 a year; but for 1885 a total expenditure of under $24,000 was allowed, and at the beginning of this year there was a balance of less than $36,000 on hand for the expenses of all of 1886 and the first part of 1887. So small a sum is entirely insufficient to insure proper official care of the enormous mineral interests of the state. The reduction of the appropriation for last year and this is the more embarrassing on account of the requirement that the work done shall include a greater variety of investigation than had been planned by the survey. The more important subjects reported upon for 1885 are the oil and rock gas about Pittsburgh, by Carll; the structure of the Pittsburgh coal-region, by d'Invilliers; the origin of coal-beds, by Lesquereux; and the anthracite survey and the kaolin deposits of Delaware county, by Ashburner. The anthracite survey, of the greatest technical and practical value, has been seriously hampered for want of funds. The same report gives an account of the method of distribution of the survey publications followed until lately, which, to put it mildly, does not reflect credit on the legislators at Harrisburg. The original regulation in 1874 ordered, that, after supplying a very moderate number of persons and institutions at the cost of the state, all others should obtain the desired volumes only by purchase at cost. But there was little or no sale, because citizens of the state were well accustomed to obtaining state documents free of cost from their representatives: consequently, when the first volumes appeared in 1875, and a demand for them was made on the members of the legislature, an act was at once passed providing for *a special edition* of 5,000 copies of every report, for the use of the senate and house. In this way, 425,931 copies have been distributed by the legislators; and it is safe to say that a good part of this distribution has been made indiscriminately, while the survey has had practically no copies to dispose of; and of the editions published for sale, counting up to 110,569 copies, there remained unsold 43,118 copies in 1885. In view of this, an act was passed last year disposing of reports as follows: 500 copies to the senate, 2,000 to the house, 150 to the state geologist, 600 to the board of commissioners, for local institutions and general exchanges, 250 to certain state officials. This will greatly reduce the careless distribution by the legislature, and will allow the board of commissioners an authority that should have been theirs from the first. The attempt to establish a topographical survey of the state has been unfortunately a failure. The coast survey is proceeding with the triangulation of the state, and has covered about one-third of its area; but the legislature would not accept the offer of the U. S. geological survey to assist in carrying on the topographic work, even though the survey agreed to expend $30,000 a year while the state should expend only $10,000. The proper mapping of the state will cost, it is estimated, half a million dollars, and, if supported only by state appropriations of ten thousand dollars a year, would require half a century for its completion. That is too long for an intelligent state to wait.

No. 182.—1886.

COMPOSITE PORTRAITURE.

THE composite portraits which are published to-day were made from groups of undergraduates of Smith college. Figs. 1 and 2 each contains forty-nine members of the last senior class; fig. 4 is a composite of a selected group of the same class, containing twenty individuals; while fig. 3 was made from ten members of the class of '85, who formed an elective division in physics. The average age of all the groups is about twenty-two years.

These portraits may serve as text and illustration for a few remarks on some points of interest in this method of obtaining 'pictorial averages.'

The great difference between figs. 1 and 2 strikes one at once, and yet they were both made from exactly the same negatives and under the same conditions, except that in fig. 2 the nega-

tives were so adjusted that the pupils of the eyes in each case fell upon the same points of the sensitive plate, while in fig. 1 the distance from the line of the eyes to the mouth was made constant.

The result of these different modes of adjustment is apparent in the multiple mouth which disfigures fig. 2, and in the less clear definition of the eyes in fig. 1, in which the component eyes fell upon slightly differing points in the same horizontal line.

The question at once arises, which of these faces, if either, in its general outline and expression, is the true average of the group? In seeking the typical features should we choose fig. 1, and correct the dimness of the eyes, or take fig. 2, and substitute a single mouth in the middle of the blur? As far as I can learn, this question of adjustment and its results has not before been raised. It is, however, a question of importance to all who are interested in composite photography; for only those composites which are made according to the same method of adjustment can be properly compared as types.

In any group of persons not chosen with special reference to facial symmetry, the ratio of the distance between the pupils of the eyes to that between the line of the eyes and the mouth is a variable one; and adjustment to either distance as a constant for the group will give its corresponding and differing composite. Mr. Galton makes the distance from eyes to mouth constant ('Inquiries into human faculty,' p. 359). The portraits of American men of science (*Science*, v. No. 118) seem (from the tendency to multiple mouths and noses, especially noticeable in fig. 1) to have been made, as fig. 2 was, by matching the eyes, though in these cases the beard prevents the prominence of the disfigurement which this adjustment gives in the case of smooth faces.

If a fixed distance between eyes and mouth be taken for adjustment, the composite will have a single distinct mouth, but will differ in form according to the distance chosen; if it be that of the shortest or of the longest face in the group, the composite face will be correspondingly short or long, and the indistinctness of the eyes at a maximum. But if, on the other hand, a component face of average length (i.e., one in which the ratio of the distance between the pupils of the eyes to that between the line of the eyes and the mouth is a mean one) be chosen, the resultant portrait will show a minimum indistinctness of eyes, and give what we may fairly call the pictorial average of the group. The average ratio which must serve for fixing the fiducial lines can be obtained from direct measurements on the negatives. This will not be a formidable task, if, as is usual, the negatives are taken so that the distance between the pupils is the same in all; since in this case it is only necessary to measure the distance from eyes to mouth in each, and take the mean.

This point is one which should be carefully attended to in making composites, for it would seem to be the only normal method of adjustment: all other adjustments giving more or less pronounced variants from the type.

Composites made in this way lose something of the deep-eyed, earnest expression, which is the result of superposing all the eyes of the components on exactly the same points. This loss, however, is a real gain in the truthfulness of the composite portrait, for the deep dark eyes do not represent the average, but rather a summation, and hence exaggeration of earnest expression. The face in fig. 1 is, I believe, a fairly normal composite of the group of forty-nine from which it was made; fig. 4 is from a group selected for facial symmetry, i.e., constancy of the ratio indicated, and is a type of this group with the exaggeration which comes from superposition of the eyes. Questions as to the possible dependence of the result on the order in which the components are taken, and on the time given to each exposure, occur to every one who interests himself in composite photography. In Mr. Galton's earliest paper on the subject, he speaks of six composites made from the same three components taken in their six possible combinations, and says, "It will be observed that four at least of the six composites are closely alike, . . . the last of the three components was always allowed a longer exposure than the second, and the second than the first, but it is found better to allow an equal time to all of them. In a later experiment, composites were made of four differently colored disks, whose images were superposed in four different orders, while the times of the successive exposures were equal. The result was four composite disks 'of precisely uniform tint.' The inference from this is, of course, that the order of exposure makes no difference when the times of exposure are equal (equal illumination of the image is assumed). The experiments which I have made on this point by taking composite portraits from the same components in different orders (with equal times of exposure) have shown that the order of exposure does affect the result. I have also repeated Galton's other experiment in several modified forms, both with disks of colored paper and with colored glasses (by transmitted light), and obtained results which, especially in the case of the

colored glasses (by far the fairest test), confirm those of Galton.

Experiments of this kind are far more satisfactory than those in which composite portraits are made from the same components taken in different orders: for one has to decide in the one case merely on the identity or difference of tint of disks or rectangles placed side by side on the same plate; in the other, of faces with their manifold detail.

Answers to both of these questions as to order and time of exposure would be found in knowledge of the rate at which light acts upon the silver salts of the photographic plate.

If the rate of this action is constant up to the point of a 'full-timed' plate, then the order in which the negatives are taken can make no difference, provided each successive fractional exposure is of equal length, and the image is in each case equally illuminated. If the velocity with which the chemical action proceeds is not constant, then the order will obviously make a difference in the result, unless the exposures are prolonged or shortened, or the illumination made stronger or weaker, as the velocity decreases or increases.

As far as I am aware, we have no knowledge of the rate of chemical action in this instance, except that which is given by the experiments above referred to, and which points to a constant rate of action within the limits of ordinary photographic exposures. Thus Galton's process appears as a valuable auxiliary in the investigation of an interesting point of the obscure field of photographic chemistry.

The possibility of the 'prepotency' of some individual of the group as a disturbing element was suggested in *Science*, v. No. 118, and has since been discussed by Mr. Jastrow in vol. vi. No. 134. Since the composite portrait is the result of the action of light on the silver salts, it would seem plain that no one face, however 'individual,' 'powerful,' or 'characteristic' it may be, can be prepotent in controlling the result. We must conclude that the apparently prepotent face is merely a close approximation to the type or average of the group.

In the hope that more may be induced to do something in composite photography, I would say that excellent results can be obtained with an apparatus which is by no means elaborate or costly. A camera for the purpose can be made of soft wood by any skilful carpenter. It need differ from the usual form only in having a mirror which is hung within so that it can swing down to an angle of 45° for the adjustment, and up against the top for exposures; and an opening in the top, over which a ground-glass plate is fixed. On this ground glass the fiducial lines are drawn in lead-pencil, and the images focused and adjusted. It must be at the same optical distance from the lens (the light being reflected to it by the mirror) as the ground glass at the back of the camera. A piece of ground glass placed behind the negatives will serve very well in place of a condensing lens for lighting them, and it is not necessary to enclose the gas jet in a lantern.

In order to give accurately timed exposures, I use a pendulum consisting of a wooden rod with sliding weights above and below the point of suspension, and having an arm at right angles to it. At the extremity of this arm is a screen of card or ferrotype plate, which, when the pendulum is swinging, plays up and down in front of the camera tube. Matters are so arranged, that, when the pendulum is at rest, the lower edge of the little screen lies across the horizontal diameter of the tube. After the negative is adjusted, the screen is held down so as to cover the end of the tube, while the slide in front of the sensitive plate is drawn, and then released and allowed to make a double vibration. The time of exposure is that of a single vibration of the pendulum, and this is regulated by adjustment of the sliding weights.

I find, as others have doubtless found, that the best composites are obtained from very 'dense' negatives. Those from which the composites in this number were taken were made for me by Mr. Lovell of Northampton, who succeeded admirably in obtaining strong negatives of very uniform density.

JOHN T. STODDARD.

NATIONAL EDUCATION ASSOCIATION.

IN point of numbers, the National education association meeting at Topeka, Kan., was among the most important ever held. As far as permanent educational literature is concerned, however, the contributions hardly correspond to the size of the gathering. The real value of such meetings must always be found in the quiet friction of mind with mind, and in the informal talks where men learn the experience of their fellow-teachers and become acquainted with the educational sentiment of distant sections. There is no better place than these to feel the educational pulse, and learn the temper of teachers on mooted points.

Both in the association and the council that preceded, the subject of industrial education was discussed at great length and with the widest divergence of opinion. Dr. S. H. Peabody of Illinois presented the report, which was an admirable paper, clearly and without prejudice outlining the theory of industrial education. To an outsider this whole question seems unnecessarily forced to the front. Only three per cent of our

population are living by the branches of industry in which it is proposed to establish departments of instruction. Still further, one who watches the boy of to-day will hardly find him lacking in practical ability. The great need is rather moral and political training and general culture. Principal Council of the Alabama (colored) normal school at Huntsville gave explicit and convincing testimony to the value of manual training in his school; but the condition of the south, especially that of the colored people, is so abnormal and so different from that in other parts of the country, that a general argument cannot be fairly based on it. The negro is not simply illiterate, he is ignorant, — ignorant of thrift, of ways of living, of all that goes to make a prosperous citizen; and industrial education is simply one of many ways to help him. Besides, the educational system at the south is a bare outline. It will stand some filling up. But in the north, and at the east especially, the school system has taken on load after load, until its friends momentarily wait in anxiety lest it reach the breaking-point. The enemies of the public schools are foremost in insisting that its load be increased, doubtless not without sinister reasons.

Pres. William Preston Johnson of Tulane university, Louisiana, in his paper on education in his own state, spoke of Louisiana as lowest in the scale of literacy, only forty-nine per cent of its population being able to read and write. He pleaded for the national aid proposed by the Blair bill. There was, however, in his paper, nothing to offset the arguments that have been urged against the bill. It is hard for a close student to see how the mere lavish outlay of money is greatly to overcome conditions which money can only indirectly and remotely affect.

In the department of higher education Dr. Mowry of *Education* read a paper on 'The college curriculum.' The subject was well thought out, but presented from the ultra-conservative point of view, which is meeting such sharp criticism in many quarters at the present time. The sense of the crowded meeting in which Dr. Mowry's paper was read, was, however, clearly with him. The discussion was sharp.

The subject of alcohol and narcotics occupied large space in the meetings. The presentation was vigorous, though nothing was set forth new to those familiar with the work.

A department of secondary education was formed at the request of the high school and academy men present. It will be restricted exclusively to work between the elementary schools and the colleges.

The department of musical education suffered a serious loss in the absence of its president, Dr. G. Stanley Hall, who was detained at Ashfield, Mass. The papers read offered no noteworthy addition to the present literature of the subject.

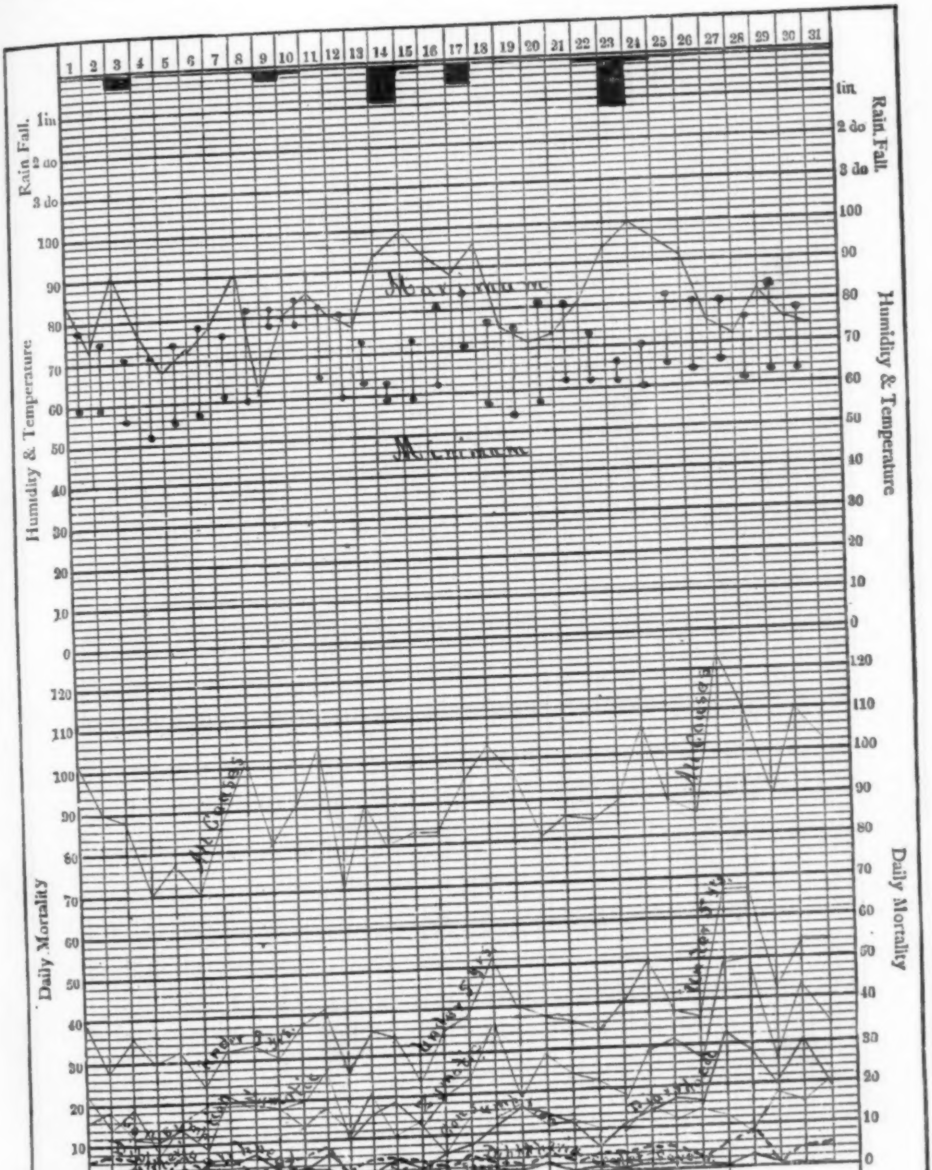
The kindergarten and industrial displays were unusually attractive; the Kansas agricultural college occupying a prominent place, and displaying some excellent work.

Altogether the meetings may be held a success. The place chosen was hardly fortunate, public accommodations were frightfully limited, and the heat at times was appalling. But western hospitality never showed itself in a more enthusiastic and delightful way. Houses and hearts were cordially open, and the torrid weather was cool compared with the welcome extended an all sides.

THE HEALTH OF NEW YORK DURING JUNE.

THE population of New York on the first day of June may be considered as 1,435,290. Of this number, 2,762 died during the month, an excess of three as compared with May. While, however, the total mortality for the two months was so nearly the same, the number of deaths of children under five years in June greatly exceeded that of the preceding month: the deaths in June being 1,375, as compared with 965 in May; or, to represent it in another way, had the conditions in June been the same as in May, 410 children whose deaths are recorded at the health office would now have been alive. The greatest daily mortality from all causes occurred on the 26th. On that day 124 persons died, 43 of them being under one year of age, and 66 under five, or more than one-half of the total mortality being children of this tender age. The causes of death on this day were as follows: 32 persons died from diarrhoeal diseases, 13 from consumption, 12 from diseases of the brain and nervous system, 8 from diseases of the kidneys, 5 from diphtheria and the same number from cancer, 4 from pneumonia, 3 from croup, and 2 from rheumatism and gout. Consumption still leads the list as a mortality factor; taking the month as a whole, 423 persons having succumbed to that disease, 72 less than in May. Diarrhoeal affections increased more than fourfold, these deaths being 303, as compared with 73 in May. Diphtheria, with 130 deaths, showed a reduction of 35 deaths; while scarlet-fever is charged with but 29 deaths, as against 44 in the month preceding.

The meteorology of the month is full of interest. The mean temperature for the year has been as follows: January, 26.79° F.; February, 27.45° F.; March, 37.60° F.; April, 52.87° F.; May, 60.18° F.;



Weekly Mortality	577	627	620	665	
Weekly mean Thermometer	66.5	68.8	67.3	68.4	
Weekly mean Barometer	29.908	29.905	29.822	29.911	

June, 68.03° F. As compared with the preceding sixteen years, June of 1886 was a cool month: in but two years, 1879 and 1881, has the mean been so low. The maximum temperature was 84° F.: this was reached on the 10th at 5 P.M., on the 17th at 1 P.M., and on the 29th at 5 P.M. In no year since 1869 has the maximum been so low for the month of June, the lowest being 88° F. in 1881, while it has in thirteen different years since 1869 been in the nineties, and in 1874 was as high as 98° F. The rainfall for the month was 3.35 inches, slightly above the average for sixteen years, which was 3.01 inches: it was less than that of May by 2.05 inches, but greatly in excess of that of June, 1880, which was only 1.32 inches. The number of days on which rain fell was nine.

It is of interest, in connection with the subject of temperature, to compare the maxima as recorded in the cities of New York and Brooklyn. The meteorological observations for the former city are made at Central park at a height of 97 feet above the sea: those for Brooklyn are made at Prospect park, 220 feet above the sea-level. The following table shows the maximum and minimum temperature for each day of the month of June at these two recording-stations, and the mean for the weeks ending June 5, 12, 19, and 26.

1886	Max. temp.		Min. temp.		1886	Max. temp.		Min. temp.	
	N. Y.	Bkln	N.Y.	Bkln		N. Y.	Bkln.	N.Y.	Bkn
June 1	78	74	59	58	June 16	81	77	62	60
" 2	75	69	59	57	" 17	84	82	71	66
" 3	71	70	56	62	" 18	77	82	57	63
" 4	71	72	52	55	" 19	75	74	54	57
" 5	74	72	55	57	" 20	81	79	57	59
" 6	78	75	57	57	" 21	80	78	62	65
" 7	76	71	61	55	" 22	73	72	62	60
" 8	82	79	60	62	" 23	66	72	62	60
" 9	78	78	59	61	" 24	70	69	60	64
" 10	84	79	59	64	" 25	82	77	65	61
" 11	82	80	65	65	" 26	80	79	64	63
" 12	80	76	60	64	" 27	80	79	66	63
" 13	73	70	63	62	" 28	76	74	61	62
" 14	63	64	59	57	" 29	84	83	63	65
" 15	73	72	59	57	" 30	78	77	63	66

Mean for the week ending

June 5.		June 12.		June 19.		June 26.	
N.York	B'klyn	N.York	B'klyn	N.Y.	B'klyn	N.Y.	B'klyn
66.5	65.98	68.8	68.86	67.3	65.98	68.4	67.19

It will be seen that Brooklyn has, as a rule, a lower temperature than New York. Whether this is due to the difference in elevation of the reading-station, or to some other cause, we do not know. At some future time we hope to be able to give the record of temperature as observed in the hearts of the two cities, which is really the temperature which has a direct bearing upon the public health, rather than that which obtains at such salubrious localities as Central and Prospect parks.

PARIS LETTER.

As the centennial anniversary of the French revolution is to be celebrated here with great display, the government is pushing on with great eagerness all preparations concerning the exhibition of 1889. The plan of the buildings is not yet exactly chosen, but will be soon. It is, however, already decided that a large and very high tower shall be erected in the middle of the exhibition buildings. The Eiffel tower — as it is called, after the name of the man who is to build it — will cost a million of dollars. It is to rest on two legs, which meet and coalesce to form a single tower supported by them. The arch thus formed will be wide and high enough to allow a free and easy passage to the whole of Notre Dame, if this cathedral were to come and ramble about the exhibition. The whole tower will be seven times as high as the *Arc de triomphe*. At present the question is how one shall get up to enjoy the very fine view that will be afforded from the top. An elevator can be used only in the vertical part of the tower: in the two legs, one must devise some other plan, on account of the incline. It is believed that in the first, non-vertical part, a funicular railway will be used; in the other an elevator will do very well. But, of course, both systems must be very well combined, and every thing possible must be done to insure the safety of the amateurs who wish to ascend the tower. This is not the easiest part of the task of M. Eiffel. The building is to be begun as soon as the necessary funds have been voted by the senate.

A very interesting meeting was recently held at the Academy of inscriptions. Some days after I sent my last latter, it was rumored that M. Maspéro, the very modest and able director of the Boulaq museum of Cairo, had found some very antiquated and interesting mummies. These were found, as he wrote to the academy, in a *cachette* of Deïr el Bahari, not at all in their tombs: they had been hidden to prevent violation. The mummies were undone in presence of Nubar-Pacha, Sir Drummond Wolff, and the khedive.

It was then easily ascertained, by means of the inscriptions on the cloths surrounding the mummies, that one of them was the body of Ramses II. This is certainly a very interesting fact; and it is easily believed that to assist at the unveiling of the corpse of a great conqueror, such as Ramses, who died forty centuries ago, causes an emotion of a rare and novel nature. A photograph of the mummy was produced at the meeting of the academy, and created quite a sensation. Although forty centuries have passed over this dead body, the face is in an excellent state of preservation. The

expression is that of a man of high blood, grave, and full of will. The head is rather small; the hair white and rather thin, especially in front. The jaw is very strong: there are no teeth in the mouth. The hands are very elegant, and are yet reddened by the *henné*, which was used for the body's last toilet.

Two other corpses have been found. One was in the sarcophagus containing the remains of Ramses II. The body was not as well preserved. It is believed to be one of the sisters or daughters of Ramses. The other corpse is that of Ramses III. The face is that of an intelligent and refined man, but the expression of power and will is less pronounced. The mouth is very large, and the teeth are all in good order. M. Maspéro intends to have these royal corpses renovated and set in good order: they will then be exposed in the Boulaq museum, where everybody can look and wonder.

Apropos of the recent census of Paris, the full results of which I have not yet seen, some papers have recalled some peculiarities of the last census, taken in 1881. At that time there was one married man of seventeen, one married woman of fourteen, three widowers of eighteen, and two widows of sixteen. Instances of old age were pretty frequent: 6,386 persons were aged over 80 years; 2,747, over 85; 640, over 90; 138, over 95. There were twenty centenarians, — four bachelors, one married man, six widowers, one unmarried woman, one married one, and seven widows. It seems that conjugal life is not very favorable to old age: misanthropes, or rather misogyns, may take a hint, and philosophers may moralize on this statistical fact. Although the full results of the 1886 census are not known, it is certain that the population of Paris has increased by a hundred thousand persons since 1881. Artists of all sorts are very abundantly represented in Paris; the number being 42,626, of whom over 20,000 are women.

A surgeon of Tours, Dr. Thomas, has recently communicated a very interesting fact concerning the surgery of the fingers. A man, while passing over a gate, lost the whole skin of one of his fingers; a ring around one of them having got caught between the gate and an iron bar, and the weight of the man while jumping having forcibly dragged the finger through the ring. The ring and the skin remained an entire hour on the gate. Dr. Thomas secured both, and reintroduced the scalped finger into its normal envelope. Although the whole skin did not adhere, a good part of it was restored to life; and it is possible, that, if the operation could have been performed earlier, the result might have been quite satisfactory.

M. Grancher, professor in the medical school of Paris, and medical assistant of M. Pasteur, especially in anti-rabid inoculations, — Pasteur not being legally qualified for medical practice, — recently gave a very interesting lecture at the Paris exhibition for hygiene, on rabies. He divides the persons who apply to Pasteur for treatment into three classes, — 1°, those who have been bitten by dogs positively rabid, which have communicated rabies to other dogs, or from whose nervous system rabbits have been rendered rabid; 2°, those bitten by dogs pronounced rabid during life or after death by veterinarians; 3°, those bitten by dogs of which nothing is known. Putting aside persons bitten recently, and whose fate is yet uncertain, M. Grancher says that the total of persons coming under the three preceding classes is 1,335. As to the first category, according to a very severe and strict statistical review by M. Leblanc, the usual death-rate of persons bitten and not inoculated is 16 per cent. When Pasteur's method is employed, this death-rate is only 1.04 per cent. In the second category, with Pasteur's treatment, it is only 0.46 per cent. No account is taken of the third category, for reasons easily understood. Now, if account is taken only of the persons that have been bitten in the face or on the hands, it is known, on the authority of Brouardel, that the usual death-rate is 80 per cent. With Pasteur's method, the death-rate becomes 1.80 per cent for the first category, and 0.75 per cent for the second. As to wolf rabies, the preventive inoculations seem to exert a very powerful and useful influence. The normal death-rate is 66 per cent; on inoculated persons it is only 14 per cent.

Upon the whole, the more time advances, the more Pasteur's method seems to be a really useful one, and one of which much is to be expected in the future as well as in the present. But this success must also be a very forcible incentive to the study of the manner in which other parasitical diseases may be prevented. Rabies is certainly a very terrible disease; but it must be said, that, although very deadly, it is not an important cause of death. It would be much more useful for mankind to be able to cure tuberculosis, diphtheria, cholera, or the yellow-fever; and it is to be hoped that Pasteur and others will give their attention to the subject. Pasteur's splendid success is well fitted to give an impulse to new studies and researches, and we sincerely hope that it will. Much is done, certainly, by Jenner's and Pasteur's work, but much more remains to be done. The only difference is, that future experimenters are in possession of a method of study which had hitherto been totally wanting. From a theoretical point of view, there is no *a priori* reason against the

possibility of preventing or curing parasitic diseases, such as tuberculosis, cholera, diphtheria, etc.

At the last meeting of the Academy of medicine M. J. Rochard gave some very interesting notes concerning the consumption of alcohol in France. During the last forty years, the annual quantity of alcohol which is used for drink has nearly doubled, but the evil which has resulted therefrom has more than doubled. This is due, according to M. Rochard and others, to the impure quality of many alcoholic drinks or liquors, and to the fact that amylic alcohol is often added to ethylic. It is well known that amylic alcohol is a dangerous and deleterious liquid, and even in small quantities a real poison. Since 1880 the number of *cabarets*, or wine-shops, has become very great: the number is 320,000, and it is calculated that there is one *cabaret* to twenty-five persons. The great abundance of deleterious alcohol may be explained in part by the decrease of production of ordinary wines, due to the ravages of phylloxera. The result is, that a great amount of Spanish or Italian wines of inferior quality are brought into France: as they have no taste, alcohol is added, and almost always amylic alcohol is used. As the senate asked the opinion of the Academy of medicine concerning the question, the academy has answered as follows: First, the addition of alcohol ought to be forbidden; sugar only ought to be added during the fermentation process. Government ought to prevent all introduction into France of alcoholized wines, and prevent the traffic in wines containing over twelve degrees of alcohol: twelve degrees must be the utmost allowed, instead of fifteen as at present. Lastly, the number of *cabarets* ought to be much diminished, and they ought to be very well and frequently inspected. Such is the course proposed by the Academy of medicine. The different conclusions adopted by a special committee will be discussed at the next meeting, and the opinion of the academy will then be sent to the senate. In our next letter we shall let you know the result of this discussion.

In another recent meeting of the same society, M. Andouard of Nantes communicated an interesting note concerning some cases of excellent preservation of dead bodies, notwithstanding exposure. It has long been well known that corpses become mummified in dry sand or earth, or in heated deserts. It may be so in constantly heated rooms; but it has not been ascertained yet that a dead body exposed to open air can also escape decomposition, or rather putrefaction. It is well known, however, that in Toulouse, for instance, dead bodies are very well preserved in open air, when they have been entombed for a year or two in an hermetically closed vault; that at the great St. Bernard pass in Switzerland the bodies of the travellers killed by avalanches, or frozen during their journey, as well as those of the monks who live in the *refuge* of the pass, are never buried, but simply laid out in small buildings or underground cellars; and they never decompose, on account of the dryness of the air, and the cold which always prevails, — a very singular and interesting sight which travellers ought not to forget to ask for when they cross the pass in summer. But in both of these cases there is a reason for non-decomposition. In the first, corpses become saponified by remaining in dry air; in the second, cold is the agent of preservation.

M. Andouard recently met with a case in which a young girl remained a whole year in the place in which she was murdered. The body, one year after death, was so very well preserved that it was thought that some chemicals or antiseptics had been used. In fact, none had been used; and the preservation of the body — in a cellar — was due to the fact that the temperature was low, that ventilation was very imperfect, hardly possible even, and that the cellar was very dry. In fact, there was in this case a natural combination of the conditions favorable to non-decomposition. The changes in the tissues of the corpse were very curious. The body had lost a great deal of weight. The skin was hard, dry, and rigid. Muscular and vascular tissues underneath had all disappeared: in place of these was found a sort of fibrillar substance, of a spongy nature, made up of dried cellular and conjunctive tissues, and of a sort of dust. This dust was the result of an incalculable amount of dead *acarii* and of their eggs; and the presence of these insects is the reason for the preservation of the body. They absorbed all liquid and putrescible structures. M. Andouard's paper is a very useful one, and it would be very interesting to meet with other similar cases. In fact, the decomposition process of dead bodies, either buried or unburied, is not very well known, and the matter is worth studying.

Professor Mosso of Turin has recently made known, in the *Archives italiennes de biologie*, many interesting results of his experiments on the respiratory function. His conclusions are new, and the facts he has discovered had hitherto escaped observation. First of all, he noticed that there is no regular respiratory rhythm, but that there are some pretty regular irregularities in the way we breathe. During heavy sleep, these irregularities are very noticeable, when Marcy's pneumograph is used. There are regular series of deep and strong inspirations, followed or separated by series of

shallow and weak ones; and in both of these series the diaphragm and thoracic muscles do not take equal parts. When the diaphragm works much, the other muscles take some rest, and reciprocally. When mind and body are quiet, the respiration is less deep and more frequent, and the diaphragm is somewhat lazier than usual. But a more important fact is, that the number and depth of the respiratory movements are not proportioned to the needs of the organism, and the conclusion drawn therefrom is, that we usually breathe more than is necessary, when in ordinary conditions under the sea-level barometric pressure. For instance, on high mountains we breathe less air than on the sea-level, and do not find ourselves any the worse for it. M. Mosso gives many other very interesting conclusions, some of which refer to the Cheym-Stokes respiratory rhythm; but we cannot give more than the principal facts in this letter. However, we must quote the singular and unexpected conclusion, that there is no unique respiratory centre. This conclusion seems rather difficult to admit, but the matter is worth investigation. Professor Mosso's memoir is a very long one, and cannot be easily reviewed in a short space.

Another interesting paper on the biological sciences is that of Professor Sanson, on 'The comparison of the living organism as an animated motor with the steam-engine.' His conclusion is that the animated motor is more economical than the engine, if it is asked, not which of the two gives most work, but which gives the kilogrammetre at least cost-price. But this conclusion applies only to cases in which a great expenditure of force is not required. For instance, in cases where twenty horses can do as well as a steam-engine, it is more economical to use the horses, and it is all the more so that less energy is required; but if fifty horses can do the work of a steam-engine, it is better, that is, more economical, to have it done by steam. Professor Sanson's paper has been published in the *Revue scientifique* of June 19, 1886.

An interesting thesis was published some days ago by M. L. Boutan, assistant of Professor de Lacaze-Duthiers. The subject of it is the 'Anatomy and development of Fissurella,' a gastropod mollusk. The most important fact is, that in larval development, Fissurella passes by two stages which very much remind us of two adult gastropod forms of life: one resembles Emarginula; the other, Bimula.

Among the recent publications I will point to the supplementary volume published for 1886 by the *Archives de zoologie expérimentale et générale*. As this scientific periodical is now overcrowded, some contributors conceived the idea of publishing their own memoirs at their own expense, and making a volume identical with the ordinary one; as is often done by the *Zeitschrift für wissenschaftliche zoologie* when papers are too abundant. This supplementary volume, printed and bound exactly in the same style as the ordinary ones, contains four memoirs. One is by Y. Delage, professor of zoölogy in the Sorbonne, on a Balaenoptera musculus found on the Normandy coast. It contains a number of new anatomical facts concerning this animal, and is accompanied by a series of very fine plates. The second memoir relates to the physiology of muscular contraction of invertebrated animals (with thirty-five *graphiques*), by H. de Varigny, D.Sc. The third is by J. Deniker, D.Sc., and is an excellent monograph of a Gorilla foetus, from an anatomical point of view. Very little has been known hitherto on that subject. The last one is M. Boutan's memoir, of which we have just spoken. This supplementary volume is a very big one, and contains a great many more engravings and plates than the ordinary ones do. It is to be hoped that the enterprise of the authors will prove successful, and encourage other similar experiments.

V.

Paris, July 10.

NOTES AND NEWS.

PROFESSOR WEICHSELBAUM of Vienna has recently collected the opinions of the leading medical authorities on the causation of pneumonia, and regards the proof of its bacterial origin as abundantly established. He has investigated one hundred and twenty-seven cases, besides having made a large number of experiments, using the material obtained from lungs affected with this inflammation. As a result of his labors, he finds four varieties of micro-organisms in this affection: 1. The diplococcus pneumoniae, which occurred in ninety-one of the cases (these are oval, elliptical, or round cocci, and are sometimes in pairs and sometimes form chains); 2. Streptococcus was found in twenty cases (this microbe resembles the first variety, but is, as a rule, more spherical); 3. Staphylococcus aureus s. albus was detected only in secondary pneumonia; 4. Bacillus pneumoniae, as its name implies, is rod-shaped (this form was found in nine cases). Whenever other affections co-existed with pneumonia, and appeared to be secondary to it, as in meningitis, pleurisy, or pericarditis, they were determined to be due to these micro-organisms.

— The senate conferees on the naval appropriation bill have receded from their disagreement to the clause making provision for the new observatory buildings. This practically insures the ap-

propriation of fifty thousand dollars to start the work, the entire cost of which is estimated at nearly six hundred thousand dollars.

— Dr. George L. Fitch has for five years been in charge of the lepers in the Sandwich Islands. He gives it as his opinion, based on careful study and attempts to inoculate the virus into healthy persons, that leprosy is not a contagious disease.

— A new and interesting form of stereoscope has recently been described by Mr. Stroh, before the Royal society of England. The apparatus consists of two dissolving-view lanterns placed side by side, each of which throws a magnified stereoscopic picture on the screen. In front of these lanterns there is a rotating disk, portions of which are cut away, alternately shutting off the picture from each lantern. By so arranging the rotating disk as to permit each eye to see only the view from one of the lanterns during its very brief exposure, a stereoscopic effect is produced, the impression of each picture remaining upon the retina of the corresponding eye long enough to appear to be continuous.

— Prof. Charles Upham Shepard, jun., has deposited his collection of meteorites in the national museum at Washington. The collection represents nearly two hundred distinct falls, and contains many exceptionally fine specimens. The iron from Dalton, Ga., weighing one hundred and seventeen pounds, is the largest meteorite in the display, and is almost perfect. Only a small piece has been cut from the lesser end.

— Dr. William L. Dudley, late Miami medical college, Cincinnati, has accepted the chair of chemistry in Vanderbilt university, Nashville, Tenn.

— The volume of the Ray society (England) for 1885 is made up of the late Mr. Buckler's life-histories of British butterflies, with colored plates of their earlier stages. Most of the descriptions have appeared piecemeal before; but the work is rendered more complete by additions from his note-book, and new observations by his friend and colleague, Mr. Hellins. Seventeen plates, with two hundred and fifty-five figures, are given, and the drawings are better than the average. The industry of Mr. Buckler, who made all the drawings, is shown in the remarkable fact that some part, at least, of the history, is given for fifty-eight of the sixty-three British species. It is a pity that no drawings whatever of eggs are given.

— The lectures now being delivered at Oxford by Professor Sylvester on his new theory of reciprocants will appear in the coming numbers of the *American journal of mathematics*. The lectures are presented in quite simple style, and will be exceedingly interesting to all students of the modern algebra, or, more accurately, of the theory of invariants. The first eight or nine lectures will appear in the forthcoming number of the *Journal*, vol. viii. No. 3.

— 'Solar heat, gravitation, and sun spots,' by J. H. Kedzie (Chicago, *S. C. Griggs & Co.*, 1886), is certainly a book which deserves little praise. If one is not convinced by the title alone, he will find, in the rambling speculation of the author, sufficient evidence that he is treating of theories far beyond him, and of the history and development of which he knows nothing.

— The *Sanitary engineer* has collected and published in book form a number of articles which have appeared in that journal upon 'Steam-heating problems.' This collection is published partly because their previous book upon 'Plumbing and house-drainage problems' was well received. The book is intended to be useful to those who design, construct, and have charge of steam-heating apparatus.

— 'Laboratory calculations and specific gravity tables,' by John S. Adriance (New York, *Wiley*), is intended to aid students and analytical chemists in their calculations. The author has collected those tables which are constantly needed in the laboratory, has edited them with care, and it is probable that the book will be found to fill its place satisfactorily.

— Prof. B. O. Peirce of Harvard has recently published 'The elements of the theory of the Newtonian potential function' (Boston, *Ginn*), as he calls it. The book is made up of lecture-notes used by the author during the last four years, and can be used by those familiar with the first principles of the calculus. The author found it difficult to find in any single English book a treatment of the subject at once elementary enough and at the same time suited to the purposes of such as intended to pursue the subject further or wished without making a specialty of mathematical physics to prepare themselves to study experimental physics thoroughly and understandingly. The book is divided into five chapters, — on the attraction of gravitation, the Newtonian potential function in the case of gravitation, the Newtonian potential function in the case of repulsion, the properties of surface distributions (Green's theorem), and electro-statics. There are certainly few better able to produce such a book than Professor Peirce.

— Messrs. J. B. Lippincott & Co. have in press a 'Manual of North American birds,' by the eminent ornithologist, Prof. Robert Ridgway,

curator department of birds in the Smithsonian institution. The work is to contain some 435 illustrations suitably executed, and will conform to the geographical limits, classifications, numeration, and nomenclature adopted by the American ornithological union. We doubt not it will be a most important contribution to the literature of the subject, and presume that naturalist and sportsman alike will find in it an aid.

—Mr. N. S. Goss's revised list of the 'Birds of Kansas' gives notes on three hundred and thirty-five species occurring in that state, one hundred and seventy-five of which are known to breed within its limits. This little work contains the results of a large amount of labor, and is highly creditable to its author.

—'The young collector' (London, *Sonnenschein & Co.*) is the title of a very cheap and convenient series of small handbooks designed for the amateur, tastefully and neatly gotten up, and issued at one shilling each. Four of them, so far, have appeared, on 'Mosses,' by J. E. Bagnall; on 'British butterflies, moths, and beetles,' by V. F. Kirby; on 'Seaweeds, shells, and fossils,' by Peter Gray and B. B. Woodward; and on 'English coins and tokens,' by L. Jewitt and B. V. Head. These little handy handbooks contain simple directions for the collection and preservation of specimens, with a general introduction to scientific classification, habits, etc., interpersed with numerous engravings. To the boy or girl with an awakening propensity to collect (and every healthy boy at some period of his career has a more or less enduring hobby of some sort or other), these little works will serve as useful guides even in America. Why cannot some publisher get out similar and as cheap handbooks, more expressly serviceable for the young American collector?

—The longest clock pendulum known is said to be one in Avignon, France, measuring sixty-seven feet, to which is attached a weight of one hundred and thirty-two pounds. Its movement is slow, passing through an arc of between nine and ten feet in four seconds and a half.

—Mr. J. H. Long, in a recent paper on the microscopic examination of butter, arrives at the conclusions, that, "taking all things into consideration, we have no absolutely certain method of distinguishing between butter and some of its substitutes, and that, of all methods proposed, the microscopic are perhaps the least reliable." These conclusions are similar to the ones reached by Prof. H. A. Webster, but are directly opposed to those of Dr. Taylor.

—The mortality of horses in New York City during 1885 reached nearly seven thousand; and during the past six years nearly forty thousand dead horses were received at the receiving-docks.

—Recent researches by Messrs. Coleman and McKendrick of England, on the effects of extreme cold on certain microbes, especially those concerned in putrefactive changes, show that the organisms are killed by exposure to a temperature of from 80° to 120° F. below zero, though their germs are unaffected, and speedily develop after an increase of temperature.

—We learn from the *Athenaeum* that the necessary funds have been granted for the expenses of the British expedition to observe the total eclipse of the sun on Aug. 29. The party, which will probably include Mr. Maunder and Mr. Turner of the Greenwich observatory, will occupy three stations on the island of Grenada in the West Indies. Totality occurs there about quarter-past seven o'clock in the morning, and lasts very nearly four minutes. A proposal was made some time ago to despatch a German party to Benguela on the west coast of Africa, the most favorable point from which observations could be made; but we have not heard that it has assumed a tangible form. The bill introduced in congress for fitting out an American expedition seems to have been buried with some committee, and it is now, of course, too late for proper preparation, even if the bill could be pushed through.

—The president of the province of the Amazonas, Brazil, has authorized the employment of Francisco Pfaff, of Geneva, Switzerland, as the chemist of the botanical gardens established at Manaus a few years ago. It will be the duty of the chemist to study and report upon the medicinal and industrial properties of the plants of the Amazon valley.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Sea-level and ocean-currents.

The subject of sea-level and ocean-currents is not so simple that there is not room for differences of opinion. It is not to be denied that exceptionally strong winds, such as Texas northers or those of violent cyclones, often cause considerable changes of sea level in shallow water like that of Lake Erie, or of the thin stratum of the same depth, and much less near the shore, along the Atlantic coast and the border of the Gulf of Mexico, extending mostly to a distance many miles from the coast, where the bottom of the shallow water drops off abruptly into deep sea-water. But the effects of winds of the same strength upon deep sea-water are comparatively very small.

If we suppose Lake Erie to be two hundred miles in length and two hundred feet in depth, and a wind

with a velocity of forty miles per hour to blow over it from one end to the other, we have, no doubt, approximately the conditions under which Dr. Newberry made his observations. Such a wind, then, causes a surface gradient in Lake Erie of four feet in two hundred miles. The first effect of the wind is to drive the surface water from one end of the lake toward the other, and thus to cause a gradually increasing surface gradient. The difference of pressure arising from this gradient causes a counter-current in the lower strata of the lake, and the static condition with regard to change of gradient takes place when the force arising from this gradient is sufficient to overcome the friction, and maintain a counter-current sufficient to return the water below just as fast as it is driven forward above by the wind. This is required to satisfy the condition of continuity, — a condition which, in all such cases, must be satisfied after the maximum gradient has been reached, and there is no further accumulation of water at the one end or a diminution at the other.

The force of the wind is applied directly to the surface only, but is communicated to the strata below by means of the friction between the successive strata of gradually decreasing velocities with increase of depth in the upper strata, and gradually increasing velocities in the contrary direction at depths below the neutral plane which separates the direct from the counter currents. If we assume, as usual, that friction is proportional to the relative velocities between the strata, then, in order to distribute equally the force at the surface to the strata below, it is necessary for these relative velocities to decrease in proportion to increase of depth, and finally vanish; and consequently the absolute velocity must be comparatively very great at the surface, and diminish, rapidly at first and then gradually less, until the neutral plane is reached, when this velocity vanishes, and changes sign at lower depths. Since the direct velocities in the upper strata are very great in comparison with those of the retrograde motion below, it is evident that the neutral plane cannot be at any great depth in comparison with the whole; since where the velocities are least the transverse sectional areas must be greatest, in order that there may be as much flow in the one direction as the other.

Upon the hypothesis of no frictional resistance from the bottom to the counter-flow below, the relative velocities between the strata would vanish, and the maximum velocity of the counter-current would take place, at the bottom. In this case the force by which the water, held at a certain gradient by the force of the wind, tends to be restored to its level, is an exact measure of the force of the wind. This force, it is well known, is measured by the product of the mass into the acceleration of gravity along the descending gradient. But the mass for the same lake being proportional to the depth, and the acceleration proportional to the gradient, a relative measure of the force of the wind is the surface gradient multiplied into the depth. For the same wind, therefore, the gradient is inversely as the depth.

In the case of frictional resistance to the counter-current at the bottom, as there always is, of course, the maximum velocity of the counter-flow, and the vanishing of the relative velocities, take place at a plane a little above the bottom; and in this case the static gradient must be such that the force arising from it must not only be sufficient to overcome the force of the wind, as communicated by friction to the several strata down to the plane of the greatest velocity of counter-flow, but likewise to overcome the friction of the bottom, communicated in like manner upward to the strata above, as far as to the plane of greatest velocity of counter-flow, where the relative velocities vanish, and where, consequently, the effect of friction from the bottom must stop. But this is small in comparison with the whole force, and for different depths is proportional to the gradient. We therefore still have, for a relative measure of the force of the same wind, in the case of varying depths, the product of the gradient into the depth, and consequently the gradient inversely as the depth.

If, then, we suppose the depth of Lake Erie to be increased 60 times, or to the depth of 12,000 feet, a wind with a velocity of 40 miles per hour would cause a gradient of only the one-sixtieth part of the observed gradient, or 0.8 of an inch, in 200 miles; but, on the other hand, if the depth were less, the gradient would be proportionately increased. Hence it is seen how greatly the gradient, and consequently the change of sea-level, belonging to a given wind, depends upon depth. But the difference of sea-level, of course, other conditions being the same, is proportional to the length. Hence, if we increase the length of the lake 15 times, or to a length of 3,000 miles, the difference of level then would be 15 times 0.8 of an inch, or one foot. With the depth increased 60 times and the length 15 times, we have approximately the conditions of a section of the Atlantic Ocean extending from New York harbor to the coast of France; and a westerly wind, therefore, of a velocity of 40 miles per hour, would cause the sea-level to be one foot higher at the latter place than at the former. But the average wind blowing across the Atlantic we know is very much less than this, and therefore its effect cannot be nearly so great as this.

The mean annual velocity of the wind across the Atlantic in middle latitudes is approximately known from the mean barometric gradient. The difference between the annual mean of the barometer at Iceland and the parallel of 35° is about 10 millimetres; and this gives a gradient on the parallel of 45° which corresponds to a westerly wind of about 8 miles per hour. The relation between wind friction upon water and the velocity of the wind is somewhat uncertain; but it increases at least at as great a rate as the first power of the velocity, and probably at a rate considerably greater. But, assuming it to be as the velocity, then the average westerly wind between America and France causes a difference of sea-level between the two of only 2.4 inches. If wind-friction were as the square of the velocity, it would be only a half-inch. It undoubtedly falls somewhere between these two values, but even by the former the effect of the average wind in causing a difference of sea-level is very small.

But there is another argument, entirely independent of the observations on Lake Erie, or any absolute wind velocities, from which we deduce about the same conclusions. It is well known from barometric monthly averages that the barometric gradient between Iceland and the parallel of 35° is at least twice as great, on the average, in January as in July. Whatever the absolute velocities of the wind corresponding to given gradients may be, we know that they are proportional to the gradients, and conse-

quently the westerly winds must be at least twice as strong in January as in July, notwithstanding Dr. Newberry seems to think there may not be much difference. If the annual average velocity of wind, therefore, whatever it may be, causes a difference of level between America and France of 2.4 inches, then this difference in January is 3.2 inches, and in July only 1.6 inches, and consequently a change of difference of sea-level of 1.6 inches between the two seasons. The discussion of long series of tide observations on both sides of the Atlantic gives a small annual inequality of sea-level with a range of several inches; but both the ranges and the epochs of maximum height of sea-level are nearly the same on both sides, the latter occurring in the fall; and so there can be, at most, only a very small change between January and July, not possibly as much as 1.6 inches, and therefore the average wind of the year cannot cause a difference as great as 2.4 inches, deduced from the preceding argument upon the hypothesis that wind-friction is in proportion to the velocity. It is admitted that some of the data upon which these results are based are somewhat uncertain; but if some of them are in error, a fourth or even a third part, it affects the argument very little.

Upon the usual assumption that friction between the different strata of water is proportional to the relative velocities without regard to difference of pressure at different depths, it is readily inferred, from what precedes, that the absolute surface velocity is independent of depth of water, and so a westerly wind of 40 miles an hour across the Atlantic would give rise to the same surface velocity as on Lake Erie. Dr. Newberry has not furnished us with any observation of surface velocity, and therefore we cannot infer what the velocity of surface water on the Atlantic, corresponding, say, to the average velocity of about 8 miles per hour, would be. This, if wind-friction is proportional to the velocity, would be one-fifth of that on Lake Erie corresponding to a velocity of 40 miles per hour. If the wind does not blow the water against a barrier, but in circuits, of course the case is very different.

In the trade-wind latitudes the westerly component of motion is perhaps about the same as the easterly component of the middle latitudes in the North Atlantic; and, as the tropical sea between Africa and the Gulf of Mexico is much deeper, we may infer, from what precedes, that the trade-winds cannot possibly cause a difference of sea-level of two inches, and hence raise the level of the Gulf of Mexico as much as one inch above the normal undisturbed level. The winds, therefore, can have no sensible influence in producing the Gulf Stream, for this deep and rapid current can only be caused by a difference of sea-level between the Gulf and the parts in higher latitudes toward which it flows.

WM. FERREL.

Washington, July 18.

Neff's gas-wells.

In the geological map of Ohio, showing the positions of the oil and gas wells (*Science*, June 25, 1886), there is a circle enclosing these words, 'Neff's gas-wells.' This region was discovered in 1864 as geologically, and in many particulars physically, the duplicate of the Venango county, Penn., region. In 1865 well No. 1 was bored, proving the substratification of the subcarboniferous shales and sands to be the equivalents of those in Pennsylvania; but, in place of striking oil, there was developed a remarkable gas-well, which has been described by tourists and scientific men as a geyser of great violence. A full account of all the wells has been published in the Ohio state geological survey, and quite recently in the tenth volume of the Tenth census of the United States, by Prof. S. F. Peckham.

Some of the wells discharge a few gallons of oil each day, of a superior lubricating quality, gravity 32°.

The analysis of the gas is as follows: —

Marsh-gas	81.4
Ethyl hydride	12.2
Nitrogen	4.8
Oxygen	0.8
Carbon monoxide	0.5
Carbon dioxide	0.3
	100.0

There is also a small amount of free hydrogen which is carburetted before burning.

The analysis of the carbon, known as an article of commerce by the trade-mark, 'Patented diamond black,' produced from the gas of these wells by patented processes granted the writer, is as follows: —

Carbon [1]	95.657
Hydrogen [1]	0.665
Nitrogen	0.776
Carbon monoxide [2]	1.378
Carbon dioxide [2]	1.3[illegible]
Water	0.682
Ash (Fe_2O_3 and CuO)	0.086
	100.000

The pressure on these wells is not the same in all. There is a pressure for each well; at which degree of pressure there is an equilibrium between the generation or discharge of the gas, and the well's state of rest or quiet. Very little salt water is found in these wells, and it gives little trouble. Observations show that the supply increases in warm weather and in the heat of the day, and regularly with the variations of the moon, being strongest at the full moon. The gas is a rich illuminating hydro-carbonaceous gas, and, even when mixed with seven parts of atmospheric air, is a good illuminant. Well No. 2 has been systematically examined; and there is no apparent diminution in the supply of gas, during the past fourteen years of the twenty years the well has been 'blowing.' Where is it from?

That there is a limit to the supply of petroleum or gas cannot be questioned; but, with proper scientific and economical use of wells and territory, the life of a well can scarcely be measured or computed: it is too great in quantity, and too long in time.

Fresh water will 'drown out' a well. Will not holding a well under pressure until its equilibrium between a state of rest and production is about established, injure the well? It is an injury; therefore transporting gas through long lines of pipe, by an initial potential force amounting to several hundred pounds' pressure at the wells, is not the correct way. There is a reduction of pressure of about eight pounds to the mile in pipes. For long distances it will be proven that gas can be blown more economically, and to better advantage to wells and transportation, through the pipes, than be forced by its

[1] Including the C and H of 0.024 solid hydrocarbon.

[2] These gases were doubtless partly formed from solid carbon and occluded oxygen by the heat applied *in vacuo*.

initial pressure. The use of a fan-wheel may be applicable.

Although here, in and about this circle in the said map, no paying oil-well has been struck, nor does any great 'gas-gusher' 'blow,' yet good oil-sands, saturated with petroleum, are found, and a gas-belt is developed of most remarkable persistency and continuance; and the separated and scattered wells demonstrate a territory in which good paying oil and gas wells are liable anywhere to be struck. This territory embraces about the highest lands above Lake Erie, in the state of Ohio. This region gives proof of an abundance of gas for ages to come, for the supply of the surrounding manufacturing towns for light and heat.

The location of 'Neff's gas-wells' is in the eastern part of Knox and the western part of Coshocton counties, O. PETER NEFF.

Gambier, Knox county, O., July 15.

A remarkable swarm of Sciara.

In *Psyche* for September, 1880, Dr. Hagen, in discussing a swarming species of Sciara from South Carolina, made the statement, based upon Weyenbergh's list of swarms of Diptera (*Tijdskrift v. entom.* 1861), that the swarming of Sciara is new. In the *American naturalist* for February, 1881, Professor Riley states that he has frequently observed them in swarms so dense as to appear at a short distance like smoke, and quotes a letter from Dr. S. S. Rathvon concerning the swarming of a species of this genus in the upper room of a building in Bethlehem, Penn., where they were observed to issue between the floor-boards. These records indicate that some interest will attach to the following facts: —

Tuesday evening, July 20, I was sitting in my library of the second floor, when I became conscious of a humming noise, as of a distant army of flies. The noise gradually increased for nearly half an hour, when I went to the window to investigate. Outside I heard only the customary night noises; but, as I drew my head in, I saw that the ceiling of the library was covered with tens of thousands of minute midges of the genus Sciara. Except immediately above the lamp, the white ceiling was tinted brown with them. They made no attempt to reach the light, but clung to the ceiling around the edges of the room, extending down on the walls for several inches, and massed a dozen or more deep in the angles. All were in constant motion, and the noise was loud enough to drown the sounds of the crickets and tree-toads outside. The sound, as a whole, was a distinct musical note, varying but a fraction of a whole tone, and corresponded, as nearly as I could place it, with E flat above middle C. The number was beyond compute. I at once closed the windows, and in ten minutes they became almost opaque from the numbers which settled upon them. On going below stairs, I found, that although doors and windows were open, and a bright light was burning, very few of the midges had entered. I easily rid the library of those which had entered, by lighting a spoonful of pyrethrum in my ash-receiver. They fell as fast as snowflakes, and in the morning were swept up by the dustpanful.

The house is a new one, finished in April last, and is situated on a level, nearly clear plateau on Washington Heights. The gnats entered only at the second-story windows. The night was clear and not sultry, and the wind was north-east. Later in the evening a heavy shower fell. The midges were not noticed on previous or succeeding nights. From these facts it seems quite plain that the gnats were flying in an immense swarm at some distance from the ground, and either met the house in the direct course of their flight, or were attracted from their regular route by the light. L. O. HOWARD.

Washington, July 23.

Another carnivorous rodent.

Over a year ago I recorded in this journal the carnivorous habits of several of the Rodentia (*Science*, v. No. 114). In that communication I called attention to the meat-eating propensities of the muskrat (Fiber zibethicus), and a species of field-mouse, that I then had in captivity. Since writing that, I have described the field-mouse, for it proved to be a new species, and it is now known as True's Piñon mouse (Hesperomys truei). No doubt others of the same genus will be found given to a similar diet when the opportunity offers. But here comes another rodent that strongly asserts his taste in that direction, and will consume raw meat even in preference to his regular diet list, as we have always conceived it to be. This is no less an animal than the 'prairie dog' (Cynomys ludovicianus). I have at the present writing a pair, half-grown, of these engaging little pets; and for the last two days they have been fed on raw meat, refusing their ordinary food served to them at the same time. They tell me that the Navajo Indians, when they keep them in captivity, feed them with raw meat half the time, and the little marmots eat it with avidity.

As I have noticed elsewhere, rats will devour raw meat whenever they can get it, and usually in preference to other things.

In time, no doubt, it will be proved that it is a universal habit of the order Glires.

R. W. SHUFELDT.

Fort Wingate, N. Mex., July 16.

Germ of hydrophobia.

I see in your issue of July 9, p. 23, that the credit of having at last discovered the germ of hydrophobia is claimed by the London *Lancet* for Dr. Dowdeswell, who finds it in a micrococcus in the medulla and spinal cord of animals affected with this disease.

I do not remember that the attention of your readers has been drawn to the fact that this discovery had been previously claimed, with much show of reason, by Professor H. Fol of Geneva (*Archives des sciences*, vol. xiv. p. 449, 1885, and vol. xv. p. 414, 1886). According to Fol, also, it is a micrococcus found only in this disease, and so minute that it requires a good $\frac{1}{18}$ objective to see it at all. Of this micrococcus he has made pure cultures, which by inoculation communicate the disease with certainty.

JOSEPH LECONTE.

Berkeley, Cal., July 19.

A bright meteor.

The meteor recorded by Mr. Brackett as having been seen at St. Johnsbury, Vt., on the night of Aug. 11, agrees as to size and direction, as well as date and time, with one seen at Salem, Mass.

E. S. M.

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SCIENCE.—SUPPLEMENT.

FRIDAY, JULY 30, 1886.

ANOTHER VIEW OF ECONOMIC LAWS AND METHODS.

WHEN the editor of *Science* invited me to take part in a discussion upon economic principles and methods, I at first declined, because of my doubt whether any fruitful results would follow; and my final acceptance was due to the thought that the professed economists in this country were not so widely apart in their views as the expression which they sometimes use would seem to indicate, and that through discussion they might perhaps become better acquainted with each other's purposes and methods. It would be premature to say that there is no hope of realizing such an expectation, although the rigidity with which the lines between the old and the new in economy are drawn is not very encouraging. Nor is this impression wholly the result of the aggressive statements of the representatives of the 'new school;' the criticisms offered by Mr. Hadley under the title 'Economic laws and methods,' present views which by universal consent are the exclusive property of the 'old school.'

Mr. Hadley's paper is professedly a criticism upon my presentation of the relation that exists between economics and jurisprudence, but it suggests much more than was directly touched in that discussion; and, in meeting the editor's request for a 'reply,' I may perhaps be permitted the same liberty, and state, in as concise a manner as possible, the views which I hold respecting the nature and purpose of political economy, and the method of study which its profitable prosecution imposes.

If asked to define political economy, I should say that political economy treats of industrial society. Its purpose as an analytic science is to explain the industrial actions of men. Its purpose as a constructive science is to discover a scientific and rational basis for the formation and government of industrial society.

But, it may be asked, under what conditions can political economy be said to have attained its scientific purpose? When is an industrial fact satisfactorily explained? I answer, when it is referred to some general truth which, either for the sake of convenience or because our limited intelligence will not permit us to press the inquiry further, must be regarded as final. Truths of this sort are fundamental in economics, and are capable of being classified under three heads. (*a*) The first class embraces what is ordinarily called the laws of human nature. Such truths are discovered by a study of one's self, by a study of history, and by a study of statistics. There can be no quarrel between the old and the new economists as to the propriety of admitting such facts. The quarrel begins when the members of the old school assert that 'a few simple laws of human nature' furnish adequate material out of which to construct an economic science capable of explaining all industrial facts. (*b*) The truths of physical nature to which all industrial activity must conform are likewise final for purposes of explanation. Why do men go west to take up new lands? Because, to quote from Mr. Hadley, they desire "to obtain the maximum of satisfaction for the minimum of sacrifice." This, however, does not explain the fact of migrations. One does not understand why a given quantity of satisfaction can be secured for less sacrifice by an agriculturalist in the west than if he increased the numbers already living on the lands of the east, until he discovers the physical law of the productivity of land known as the law of diminishing returns. Again, it is an industrial fact that the Christian world is growing rich. Is it enough to trace this fact to the permanent desire on the part of men to grow rich? Do we not understand it better when we learn that the latent energy in a ton of coal is equal to eleven million times its own weight, and that the available energy when the best machines are used is equal to one million times its own weight? If, then, physical laws are essential to a satisfactory explanation of industrial facts, and if such explanation is the scientific purpose of economics, are we not justified in admitting such physical laws as material for the construction of the science? But, says the objector, English economy recognizes physical laws. The law of diminishing returns is called by Mr. Mill the fundamental law of economy. This is certainly true, and this is why it is so difficult for me to understand the plan of architecture according to which English economists have built their science. I cannot appreciate the necessity of bringing in at the back door any facts essential to the explanation of industrial phenomena. (*c*) The third class of final truths is disclosed when once the explanation of observed facts is traceable to the legal structure of society. Why were wages in England between the years

1200 and 1400 permanent? Why has the principle of competition exerted a greater influence since 1500 than before? Why in the year 1800 in England was the woollen industry largely controlled by journeymen, while in the cotton industry the majority of workers had never served an apprenticeship? If these questions are not legitimate ones to put to the economist, I do not know who is to deal with them; nor do I know how he can answer them except by referring them to the legal structure of society which prevailed at the time considered. For the same reasons, therefore, as were presented above, the lego-historic facts — to borrow a phrase from Lasalle — are material out of which to construct an economic science. It is true that such facts are not permanent, and when we call a truth which rests upon them a final truth, our language must be accepted with limitations; but it is a distinctive feature of the historical school to recognize limitations in periods studied. Its members are not ambitious to cover all times and all peoples with their generalizations, for they well know that such generalizations would be too thin for any use. I have brought this classification prominently into view, because Mr. Hadley insists so strongly that economics "is built out of a few simple laws of human nature," and criticises me for adding to this, as equally necessary for explaining the phenomena of industrial society, the physical and legal surroundings of men. The expression used in my former paper must have been loose, or so candid a critic and so clear a thinker would not have thus shot by the mark. And I am inclined to the opinion also that the real difference here brought to view pertains primarily to form of presentation; its discussion, therefore, would be scholastic rather than scholarly.

Still there are certain radical differences between the views expressed or implied in Mr. Hadley's paper and those which I entertain; and, should circumstances ever render it necessary for me to nail a thesis on his lecture-room door, it would include the following protests.

I protest, in the first place, against such free and unguarded use of analogy as argument. Because certain things are true in physical science, it does not follow that similar things are true in social science. One may be well versed in the methods of successful investigation in the physical sciences, and yet not possess the mental equipment necessary to arrive at truth through the intricacies of social relations. And why? For two reasons. In the one case, the forces considered are permanent and reliable; in the other, some of the forces are subject to constant variation. Development of a physical science consists in the discovery of truths which are assumed always to have existed, nor has such an assumption so far in our experience proved the source of error. Development of a social science, on the other hand, consists partly in the new discovery of old truths, and partly *in observing new truths to emerge from the growth of the social organism.* If this be true, is it not illogical to rely upon analogy? Again, the study of physical science is not complicated by the fact that the forces considered have a conscious purpose, and, within limits, are self-directing. But in social sciences this is unfortunately the case, at least the theory of social science with which the latest phase of economic science allies itself holds strenuously to the idea of a self-conditioning social organism. In this respect, therefore, analogy fails.

I protest, in the second place, against the relation that is assumed to exist between the science and the art of economics. It appears to me that they who make most use of these phrases fall also into the error of relying too implicitly upon analogy. What is said of the bearing of a science on an art, which is quite fruitful when applied to a physical science and the art of mechanical invention, ceases to have any clear-cut meaning when imputed to social relations. The reason is, that what is termed 'the art of economics' is itself one of the elements which must be admitted by the 'science of economics' in order to explain the laws of its own development. If this be true (and it must be admitted if society is an organism of conscious purpose), there is no such sharp line of distinction between the science and the art of economics as has been commonly supposed. Without denying an element of truth to what Mr. Mill so admirably states in the last book of his 'Logic,' I still insist that it is preferable to speak of a science of economics which is at the same time analytic and constructive.

I protest, in the third place, against the use of the astronomical method of investigation in the social sciences. Should my readers desire to know in what this method consists more perfectly than may be learned from Mr. Hadley's paper, they will find it presented at length in Cairnes's 'Logical method of political economy.' Indeed, that book might well be termed a handbook for the use of students in economic observatories. The method, in short, consists in this: to build a system of thought on the assumption that a certain line is straight, and then to take a squint to see how crooked it is. I would not, of course, deny that this method is, in itself considered, logical, nor that it is fruitful when employed in astronomy: my only objection is, that in economics it is of no sort of use. It has not led to a single

discovery worth the mention since the time of Mill. Ideas may have been born to those who have spent the night-watches with this method, but, if so, no one ever heard the children peep.

There are other protests which might be added. Economy is not an independent study; it is a dependent subordinate study, which first finds its true place when framed into the study of society as a whole. But says Mr. Hadley, "a scientific part is a better starting-point than an unscientific whole,"— a conclusion which he reaches after discussing the undulatory theory of light, and a conclusion which shows how dangerous it is to depend on analogy rather than on analysis. There is no such thing as a scientific treatment of one function of a developing organism which does not recognize the essential and permanent relations of that function to other forms of activity by the same organism. Nor are all economic truths 'authoritative and rigid.' Most of them are dependent and relative. There is no meaning in the science of history otherwise. HENRY C. ADAMS.

CHINESE REVENUES AND SYSTEMS OF TAXATION.

THE pecuniary relations which China is now more rapidly developing with foreign nations, together with the greater demand for foreign capital, will make of interest the following account of her revenues and systems of taxation, for which the writer is indebted to an extended article in the late numbers of the Austrian *Monatschrift für den orient*.

At the outset many difficulties are encountered in the endeavor to obtain a just conception of Chinese revenues and resources, not from any dislike on the part of the government to hinder the acquirement by foreign nations of such knowledge, but because the details of the antiquated and involved systems are not understood by the authorities themselves, notwithstanding their earnest desire to introduce a thorough reform. The imposition and control of taxes rest wholly and absolutely in the hands of the central government, under the administration of the financial minister at Pekin. What the revenues from any given province may be, the central officials, however, can give no definite information; a certain amount is demanded and usually obtained, but the details are left in the hands of the subordinate officers. The methods require an army of officials, who often make themselves enormously rich at the expense of the tax-payers. They are unusually crude in many respects, the outgrowth of old customs and habits, which, unfortunately, do not encourage much hope of improvement so long as the ultimate authority rests, as it does now, absolutely in the fiat of the chief ruling power.

The chief disadvantage under which the taxation system labors consists in the fact that the raising of taxes is farmed out. The contractors bind themselves to furnish a certain quota or sum, but at the same time enjoy the monstrous freedom of levying what they can from the people, and placing the excess in their own pockets. This may not have been the original intent, but it has become so virtually. It is not in human nature to expect, that when, in any given year, a deficit has been made up from the contractor's own resources, the following year he will carefully account for every cash[1] that he may have received in excess. It thus results that there is a constant dispute between the central and provincial authorities. The former, for instance, may demand a sum of 50,000 taels, for the emperor's household expenses, from the salt director of some province, who calls heaven and earth to bear witness that he cannot furnish another cash without bankrupting himself; nevertheless he complies with the required demand, and grows old and fat in the bargain.

Such singular, one may say pitiful, systems for a nation in many respects so intelligent as the Chinese, furnish many erroneous opinions of the nation's poverty, although there can be no doubt that the government has been in a continual state of impecuniosity since the beginning of the present century, existing from hand to mouth, and not becoming involved in debt for the simple reason that it cannot. Had the government not found in recent years a new resource in import duties, to which indeed it was compelled to take recourse, it would have been reduced to very great straits.

Two notable events in the last few decades have contributed to bring about a partial revolution in the financial systems, viz., the Taiping rebellion, and the opening up of the country to foreign nations. The first caused the almost entire abolition of the old systems of land-tax over a large part of the empire; the latter opened up the new resource of import duties, — a source of income which, were it properly managed and husbanded, would soon exceed all the others together. Yet another development since the Taiping rebellion is the so-called arbitrary *likin*, or toll-tax, which has become a very important source of revenue. All these changes render the older accounts of Chinese revenues and taxation unreliable and incorrect for the real condition of affairs at present.

The state revenues consist in, 1°, the land-tax; 2°, inland and import duties; 3°, the salt-tax or monopoly; 4°, various smaller taxes and licenses

[1] 1600 cash = 1 tael = about $1.43.

from pawnbrokers, merchants, etc.; 5°, inland transport duties, the *likin*, or toll-tax. Some other, unimportant, sources are the sale of offices, 'contributions' from wealthy citizens, etc.

As in all oriental lands, the land-tax forms the chief source of state revenue. At the close of the last century it furnished two-thirds of the entire Chinese revenue, but it has dwindled down so that at present it does not furnish more than one-third.

This tax is levied by a district chief directly upon the tilled land. In each smaller province there is an especial department for land registry, in which, in order to be legal, every transfer of land must be entered, and paid for by a certain fee. This registry shows what land and how much each piece shall be taxed. Unfortunately, a great looseness prevails in recording the sales and transfers of land,—a looseness which has now reached such an extent that it would be difficult and unjust to attempt its remedy. As a result, great irregularities prevail in the raising of the land-tax. This tax is collected by the provincial officers through the subordinate 'land overseers.'

The entire levied tax from this source, as given in the state almanac, amounts to about thirty-three million taels in silver, and four and a half million piculs[1] of rice, making a sum total of about forty million taels ($57,100,000). This tax was very seriously affected by the Taiping rebellion, which desolated nearly half of the land, including the best cultivated part of the empire. From the effects the country was a long time in recovering, nor has it by any means fully recovered yet, a proof of which is afforded by the fact that several large cities in the neighborhood of Shanghai are yet in large part fields of extended ruin-heaps. From these circumstances it is evident that the figures, as given by the national authorities, are too high, illustrating the thorough unbusinesslike methods of the government. How much they are too high cannot be definitely said, but from an estimate of the actual differences between the returns of various provinces and the levied taxes for the same, they must be decreased by at least one-third. The central government, moreover, is continually called upon to furnish relief to different provinces suffering from famine, or from damages by storms and floods, so that scarcely a year goes by in which a million taels are not thus expended.

It is also difficult to estimate with accuracy the income derived from the tax on natural productions, the so-called grain or rice tribute. A portion of this is devoted to the sustenance of the imperial army, and, like all the other taxes, is distributed unequally in the different provinces. There is a tendency to commute this tax by the payment of silver, but the monstrous abuses which such commutation opens up on the part of the officials is the greatest drawback. The total amount reaches about five and a half million piculs, worth seven and a half million taels ($10,000,000). This, however, represents the sum received by the government, by no means what is paid by the people. An evidence of what the people are really compelled to pay will be best shown by the following incident. A foreigner was required to pay a certain toll-tax of 12,000 cash on a chartered junk, which he did, but demanded a receipt. This was furnished him, but only for 6,400 cash. The discrepancy not at all suiting his ideas of business, the owner applied to his consul for relief, who, after correspondence with the officials, ascertained that the latter sum represented the actual tax; the remainder, the cost of freight on the money, the loss and cost of melting the coin and transforming it into Pekin taels, and various other expenses. One cannot but be amused at such exorbitant charges, though perhaps we in America are not wholly above reproach in similar charges on non-dutiable imports. The incident, however, only illustrates the condition of affairs over the whole kingdom. For every tael, for every picul of rice, there are added so many charges and counter charges, that the sum is more than doubled. A yet greater evil is the one already mentioned, by which every district chief or tax-receiver is allowed so much liberty in the imposition of taxes. The officers all receive like salaries and perquisites, but there exist vast differences in the value of the different posts. Each district chief must furnish a certain definite quota. The excess belongs to himself, not always to go into his private pocket, for the powers that be, whether city, state, or judicial, all come in for *douceurs*, and vice-kings, governors, judges, and commissioners all wax equally and enormously rich.

The average ground-rent for cultivated rice-land is about one dollar per acre. Of the eight hundred million acres of land in the empire, one-half is tillable; and allowing in the most liberal way for all contingencies, and estimating the average tax at less than half of that mentioned above, the amount paid by the people must reach one hundred million dollars, of which the government receives not over forty million. All the rest of this vast sum represents the cost of collecting and the aggregate stealings of the collectors.

The salt-tax or monopoly is one of the most peculiar, as it is one of the most important, sources of revenue. The empire, in its salt administra-

[1] 1 picul=100 catties=60.45 kilogr =133.13 lbs.

tion, is divided into seven chief departments, each in control of government officers, and each possessing its own places for the production of salt. Each department has its own defined limits, and the salt manufactured in one cannot be transported or sold into another. The salt is obtained by evaporation from sea-water, or from that of salt wells and marshes; and there is no restriction as to the amount and the methods of obtaining it, except this important one, it can only be sold to the government officers at a certain price fixed by the directors. From the central depots the salt is distributed to the various provinces by the salt commissioners or dealers. The amount that will be consumed is estimated, and on this basis a number of perpetual, transferable certificates are issued, worth as high as fifteen thousand dollars each, each of which empowers the possessor to buy a certain quantity, not exceeding 3,760 piculs, at a certain price, to convey it whither he will in the department, and sell it at a fixed price. He cannot, however, dispose of it direct to the consumer. In every place of any size there are storehouses under the control of government officers to which it must be conveyed. Here he deposits it, first giving up his certificate, which he does not receive back till all the salt is sold. The dealer's profits are, of course, derived from his quickness in disposing of his goods. The system is a singular one, yet not such a bad one, were it properly managed. The chief drawback that it has is the small army of detectives required to prevent smuggling between adjacent departments, an illicit traffic caused by the very great differences in price that often prevail in contiguous provinces. This tax produces the government about nine and one half million taels, only a small part, however, of what it costs the people.

The income from duties has increased rapidly since the admission of foreign trade, and now reaches about thirteen million taels annually from foreign goods, with an additional four million from opium and inland duties. The office of collector of customs and duties, as in other nations, is one of the most desirable in the government service. Well it may be, for the perquisites and stealings usually enable the possessor to retire wealthy in two or three years. The collector of Canton, for instance, spends the income of the first of his three years of service for the acquirement of the post, that of the second year in presents, and in the third and last year lays by — about three hundred thousand dollars. Many of the directors in the other ports enjoy an income of from seventy-five to a hundred and fifty thousand dollars. As in the other taxes, the loosest of systems prevail. Every collector is required to furnish the government a definite sum annually: whatever else he can get he has for himself. Even in those ports where the rates of duty are prescribed, and under the charge of foreign officers, he is not to be cheated out of his perquisites. The foreign officials have no control of the money received, which is paid over to the Chinese collector, who absorbs three-fifths, and places the rest at the disposal of the government. The central government has, however, recently expressed a desire to receive a larger share of the income: that it can fully reform the abuses is not possible.

The income from taxes on opium has very materially increased since the opening up of foreign traffic. The import duties are only moderate in amount, but, as soon as the opium comes into the immediate hands of the Chinese, it is taxed repeatedly, and to a much greater extent. About seventy thousand chests are brought in annually, each paying a tax varying from twenty to sixty taels. This income, though, is looked upon as an especial perquisite of the collector of customs, who absorbs the larger part of it.

Of the various smaller taxes, the least important are the ones on the transportation of tea to those provinces where it is not grown, and on mines. Those derived from the licensing of merchants and pawnbrokers are more important, especially from the latter, each of whom is required to pay a license of from one thousand to five thousand dollars, and yearly dues of one or two hundred dollars. Another source of income, that of the payment for registry in land transfers, would be important were the laws enforced, which they are not. The fees amount to three per cent of the sale-price, but they are often evaded by an understatement of price, or even by the neglect to record the sales at all, though non-recorded sales of land are illegal.

The most characteristic Chinese tax is the *likin*, a toll-tax, or duties on inland transportation. This tax has given rise to dispute on the part of foreign governments on account of its illegality, or, rather, perversion of international treaties. That it is illegal in any other sense cannot be said, for the simple reason that in China the highest form of legality is the emperor's decree.

This tax, which is of recent introduction and has only assumed importance within the last twenty years, is imposed upon certain classes of goods in their transportation across the country. An imperial decree authorizes the levying of it in any given province, whereupon a central provincial office and toll-stations are established, their number depending upon the amount and kind of traffic, averaging upon the most important thoroughfares, whether by land or water, one in about

every ten miles. The tax at each station is small, but, when the distance traversed is great, it may reach fifty per cent of the gross value. No definite control can be had over the income of these stations, as there is little or no check upon them. In fact, the officers in charge generally get what they can from the transporter, whose willingness to pay depends very much upon whether he can evade the tax by going round the station. Often the carrier and collector wrangle over the price, and finally settle upon one much less than first demanded. The data for estimating the sums derived from this tax are more reliable than those of any other. The minister at Pekin gives between seventeen and eighteen million taels as the annual income from this source, and his figures are probably nearly correct. Of this amount, about one-half is derived from *likin* on salt and opium, the remainder from various other goods.

The entire amount of all the taxes which have been spoken of reaches the sum of sixty-eight million taels, or ninety-seven million dollars. The amount which each province has to furnish is estimated annually by the minister of finances. Should some extraordinary necessity, as famine or war, require larger contributions than are laid down in the annual budget, those provinces most likely to respond are called upon for additional amounts. When the last cash is exhausted from these sources, then recourse is had to extraordinary means, appeals to wealthy citizens, requests couched in such urgent terms that a disregard of them is perilous.

Not many reforms can be expected in China's financial systems. The absolute monarchical government, the hordes of mandarins who find their living in the present systems, and the yet general distrust of foreign advice and counsel, all hinder the empire from throwing off the shackles that now impede her every movement. S. W.

DRAWING IN PUBLIC SCHOOLS.

FOR many years past, those who are most interested in improving the elementary education of this country have been agreed that far more attention ought to be bestowed upon the art of drawing. Those especially who are interested in schools for manual training and in scientific schools have been firm in demanding that all young scholars should be encouraged, if not required, to attain some proficiency in this useful art. Many have insisted that drawing should be placed next in importance to reading, writing, and arithmetic, and have regretted that the children in public schools have been forced to give so much time to acquiring a familiarity with geographical nomenclature, when an equal amount of labor would have trained the eye to observe with minute accuracy, and the hand to delineate with truth that which the eye has seen. Notwithstanding this unanimity of opinion among those who are qualified to give advice, the schools of the country are in general far from doing what they ought, to provide instruction in drawing. Great advances have been made within the past fifteen or twenty years; and in certain schools, and even in certain groups of schools, good results have been attained. It is now most important that the experience which has been acquired, and the methods which have been successfully employed, should be ascertained, compiled, and promulgated in such ways as will secure the widest consideration.

For many years past, Mr. Isaac Edwards Clarke, of the Bureau of education, has been engaged in compiling such a report. Two or three times his work has been made ready for the printer; but its issue has been postponed for the lack, we believe, of adequate appropriations from congress. At length we have before us a volume of a thousand pages, distributed in four parts. There is, first, a series of papers by the author on 'The democracy of art;' then an account of the efforts which have been made to secure instruction in drawing in the public schools; third, a series of statistical tables illustrating the condition of art schools and museums; and, finally, an appendix, occupying four hundred pages, and including a great variety of reports, lectures, and schedules pertinent to the subject of art education. The work is very comprehensive, being evidently designed for very different sorts of readers, — those who are interested in the historical aspects of the subject, those who need to be persuaded of the importance of art education, and those who require to be enlightened in respect to methods of instruction which have been employed. By the use of the elaborate index, readers of all these classes may derive from this volume much useful information not otherwise accessible; but the author would have rendered an additional service if he had added with greater freedom his own critical comments upon the various plans which have been adopted. His preliminary essays reveal the mind of one who has long been familiar with the progress of the fine arts, and who has been accustomed to reflect upon their relation to the progress of society. He points out with clearness the influence of taste and skill upon the enjoyments, the trade, and the prosperity of the people. He touches with facility upon all the indications which are to be seen, especially

Industrial and high art education in the United States. By I. EDWARDS CLARKE. Washington, *U. S. bureau of education*, 1885.

in architecture and manufactures, of American progress. He writes with enthusiasm and sympathy, aiming to encourage what is good rather than to contemn what is bad. He has apparently in view as his readers the managers of public education, and he strives to incite them by the description of what has been accomplished, and by gently persuasive illustrations, to 'lend a hand' in the new educational movement. His purpose is deserving of the highest commendation; and the facts and figures which he has brought together, with a vast amount of painstaking, will prove to be a store of arguments and examples to be drawn upon by innumerable commissioners, superintendents, and directors of education in schools of every grade, from the kindergarten to the university.

TRIUMPHANT DEMOCRACY.

MR. ANDREW CARNEGIE is well known as a shrewd and successful business man, a capitalist of great wealth, a traveller of experience, and an American citizen of public spirit. He is an excellent type of a class more numerous and more influential in America than in any other country of the world: he is eminently a practical man. There is a wide-spread impression that the practical man is not only more competent to carry on affairs, but that he has a great advantage over the theorist, buried in his books and unacquainted with human nature, in the theorist's own walks in life; that he can, if he tries, run a better newspaper, secure better legislation, and write a better book. When the practical man, therefore, enters the field of literature, and discusses important public questions, much is expected of him: his knowledge of affairs should give him a broader point of view; his observation should be keener; his information should be more exact and more complete; he should have a better grasp of the principles which have grown to be axiomatic, a greater power of combining facts and principles into general statements; his views should be more vigorous and more lucid than those of the ordinary writer.

Judged by this high standard, it must be frankly confessed that 'Triumphant democracy' is not successful. The author's point of view is sufficiently set forth in the dedication, the keynote of the whole work: "To the BELOVED REPUBLIC under whose equal laws I am made the peer of any man, although denied political equality by my native land, I dedicate this book with an intensity of gratitude and admiration which the native-born citizen can neither feel nor understand." To make the native-born citizen appreciate the full measure of his birthright, and to teach the foreigner the blessings of the American system, the first requisite is accuracy of statement. If grave errors of observation and of statement of fact are found, the effect of the book is marred, if not wholly taken away. What will the native prohibitionist think of the statement that 'drunkenness is quite rare' among American workmen (p. 125)? What will the Norwegian say to the assertion that 'the lumber-trade is an industry peculiarly American' (p. 219)? How will the man who remembers the Mexican war accept the glorification of "the American people [who] have never taken up the sword except in self-defence or in defence of their institutions" (p. 265)? Can the author ever have been in Germany without knowing that the United States is not "the country containing the smallest proportion of illiterates" (p. 489)? Does any man who thoughtfully considers the present state of public feeling in France believe that 'the reign of the masses is the road to universal peace' (p. 102)? Is the practical man satisfied that "the theatres and opera-houses of the principal cities in America are, of course, much superior to those in Europe because they were built more recently" (p. 336)? The passages just quoted are fair examples of recurring errors, mistakes, incomplete statements, and hasty generalizations.

The idea of the book — to put into readable, entertaining form the causes of the marvellous growth of America — the idea is not a bad one: the execution is totally inadequate, and inadequate for a very simple reason. Mr. Carnegie has been too busy in doing other things to give the necessary time for reading and reflection: his knowledge is insufficient. That the United States is triumphant we all know: that the triumph is wholly or largely due to democracy may or may not be true; but Mr. Carnegie has not proved it: if it is ever to be proved, it must be by the despised theorists, who are willing to spend a lifetime in grovelling after the dry details of the history of many nations.

A. B. HART.

Triumphant democracy; or, Fifty years' march of the republic. By ANDREW CARNEGIE. New York, *Scribner*, 1886. 8°.

PRESTWICH'S GEOLOGY.

THE reputation of Professor Prestwich as a geologist lends an especial interest to the appearance of a general treatise from his hands, embodying the facts and theories that his long experience has led him to regard of the greatest value to the student. The first volume of the work, lately issued by the Clarendon press, treats of subjects chemical and physical. The second volume, not

Geology, chemical, physical, and stratigraphical. By JOSEPH PRESTWICH. Vol. I. Oxford, *Clarendon pr.*, 1886. 8°.

yet published, will include chapters on stratigraphy and paleontology, and a discussion of theoretical questions connected with historical geology and the evolutions of the earth. This will therefore probably be the more entertaining of the two; but the book now before us is attractively written and makes easier reading than most geological manuals. Its style is between the extreme condensation of the encyclopedic text-books, and the more literary form of Lyell's 'Principles.' Except in the chapters that are necessarily occupied with simple definition and tabulation, there is a satisfactory amount of argument and discussion, and a careful presentation of both sides of a question; so that the learner's attention is held to the facts long enough to allow him to acquire them familiarly, and to perceive that their proper understanding requires a higher mental process than mere memorizing. The work is further intentionally a statement of the evolutionary rather than of the uniformitarian view of geology, which Lyell's leadership so long in England placed too prominently before many students: there was under Lyell's teaching no room between uniformitarianism and catastrophism for the safer middle ground which Prestwich clearly states, and which is now certainly the dominant view held by working geologists. The change in the rate of denuding processes and of eruptive action from ancient to later geological times may be named in illustration of this. Under the latter subject, it is an additional satisfaction to see prominence given to the mechanical origin of eruptions, and only a subordinate importance attached to Scrope's theory of the action of steam and other gases; and to find definite statement of the metamorphism of eruptive as well as of sedimentary rocks. Indeed, it would be easy to name many more examples of treatment that must commend themselves to the American as well as to the English taste, while there are only two sections that are likely to excite any general dissent,— one on the origin of valleys, which attributes too much influence to fissures to find full acceptance, at least in this country; and another in which much importance is attached to Elie de Beaumont's extinct theory of parallel mountain-ranges, which is certainly given more space than students in this last quarter of the century should ask for it. The author's familiarity with the geology of this country has not been such as to prompt many quotations from our surveys, nor to change the triassic coloring of the copper-bearing rocks of Lake Superior on the reduced copy of Marcou's geological map of the world, which serves as a frontispiece; so that, as a book for class reference in our higher schools and colleges, this work will hardly gain the reputation of Geikie's text-book: but, if the excellent fashion of placing different books in the hands of every member of a class could be introduced, this one would certainly be one of the most popular.

W. M. D.

PORTER'S MECHANICS AND FAITH.

THIS work is one of those attempts, so common in our day, to 'reconcile science and religion.' The main thesis of the author, which he endeavors through many chapters to prove, is this; that all truth, physical and spiritual, is made known to us by 'revelation,' and could never become known to us by any other means. Thus, he says that in mechanical science, "man, in his conscious ignorance, and with a sense of entire dependence, makes his appeal immediately to the Infinite Source of truth; that the methods of experiment and observation are the divinely appointed way in which this appeal is made and the revelation of physical truth is received" (p. 32). Having established this thesis, to his own satisfaction, he goes on to infer, that, since all other truth is given by revelation, we should naturally expect that religious truth, the most important of all, would be given in the same way. Thus he thinks to establish the doctrine of revelation in the theological sense.

Now, in all this there is great confusion of thought, resulting from the use of the word 'revelation' in two quite different senses. The 'revelation' which the author speaks of in physical science is nothing but the presentation of objects to our senses, and this is not a revelation of truth at all. Truth is not a property of objects, but of thoughts; and all our thoughts, whether true or false, are the product of our own mental activity. It is absurd, therefore, to say that scientific truth is revealed to us from an external source. On the other hand, the sacred books of religion are held to contain religious truth itself in the form of propositions, and we have nothing to do but to receive and assimilate it. At best, therefore, there is nothing more than a poetic analogy between the two cases, and nothing whatever to base an argument on.

Mr. Porter's main doctrine being thus defective, it is unnecessary to criticise his book in detail; but we would call attention to the chapter on 'The revelation of God,' as an example of the author's method. He expressly says that God cannot be known by the intellect, but only by love — with much more to the same effect. It is not by such methods as these that science and religion can be harmonized.

Mechanics and faith: a study of spiritual truth in nature. By CHARLES TALBOT PORTER. New York, Putnam, 1886. 12°.

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